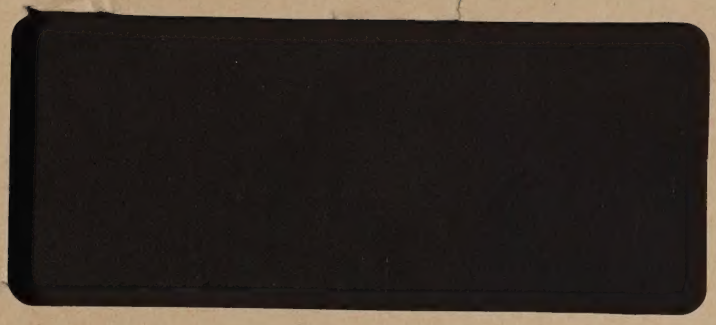
LeCroy

instrumentation
for the study of
transient phenomena

PALO ALTO, CA.



technical information manual

CAMAC Model 8501

Programmable 3-Speed Clock Generator

WARRANTY

All LRS instruments are guaranteed to operate within their specifications for one year from the date of purchase. Under this warranty, any unit which fails to perform within specifications, as a result of defects in workmanship or materials, will be restored to specified operating condition free of charge except for shipping costs involved in the return of the unit to the factory.

In order that this warranty be considered valid, it is necessary that the LRS Warranty Card which accompanies the unit on delivery be completed and returned to the factory within 30 days of receipt of equipment.

All questions concerning repairs or replacement parts should be addressed directly to factory's Quality Control Manager. This procedure will insure the fastest possible service. Please include the Model Type, Serial Number, and ECN (Engineering Change Number) with all requests for parts or service.

ENGINEERING DEPARTMENT
LeCroy / CALIFORNIA
PALO ALTO, CALIFORNIA

technical information manual

WARRANTY

NOTE TO THE USER

LeCroy Research Systems is committed to providing unique,reliable, state-of-the-art instrumentation in the field of high-speed data acquisition and processing. Because of this commitment, and in response to information received from the users of our equipment, the Engineering Department at LeCroy is continually seeking to refine and improve the performance of our products.

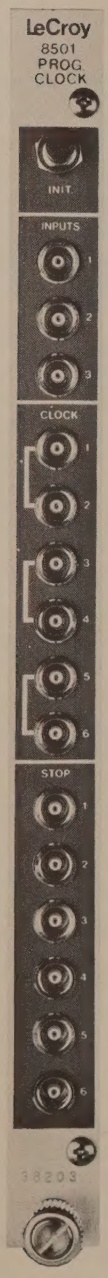
While the actual physical modifications or changes necessary to improve a model's operation can be implemented quite rapidly, the corrected documentation associated with the unit usually requires more time to produce. Consequently, this manual may not agree in every detail with the accompanying unit. There may be small discrepancies that were brought about by customer-prompted engineering changes or by changes determined during calibration in our Test Department. These differences usually are changes in the values of components for the purposes of pulse shape, timing, offset, etc., and only rarely include minor logic changes. Where any such inconsistencies exist, please be assured that the unit is correct and incorporates the most up-to-date circuitry. Whenever original discrepancies exist, fully updated documentation should be available upon your request within a month after your receipt of the unit.

If you have any questions about the performance or operation of this unit, rapid assistance may be obtained from our Engineering Services Department in Palo Alto, CA, telephone 415-328-3750, or from your local distributor in countries other than the U.S.A.

LeCROY RESEARCH SYSTEMS

TECHNICAL DATA

LeCroy



CAMAC Model 8501

Programmable 3-Speed Clock Generator

- **Flexible design**—multi-speed, multi-mode clocking.
- **High fanout capability**—drives up to 6 transient recorders.
- **Interleaving mode**—uses two transient recorders at twice the maximum sample rate.
- **Wide frequency range**—20 Hz to 20 MHz.
- **Total CAMAC programmability**—set frequencies and number of samples and enable operational modes.

The LeCroy Model 8501 is intended to provide a sequence of clocking pulses for use with the LeCroy series of CAMAC transient recorders developed for use in fusion research or in other digital data recording applications. The unit is fully programmable, or it can be externally switched on command from one frequency to another. To further optimize the use of the memory in the transient recorders, a burst mode allows the recording of multiple records smaller in size than the memory. Again, the size of the sample and the speed of the sampling can be programmed.

The unit also functions as a 2-phase clock, allowing two transient recorders to be used as a single system with double the maximum sampling rate. This solution is often more cost-effective than a transient recorder with twice the speed while permitting a reuse of the component units at lower speeds.

A front-panel pushbutton allows initialization of the sampling sequence without resort to the computer. Upon the receipt of the first external trigger to the clock module, the unit will change state to the second programmed frequency and produce clock pulses until a change is dictated by a second external trigger or a preset number of samples, at which point the clock rate changes to the third frequency and takes the final set of samples. The sequences of clock frequencies and stop triggers are fanned out to six transient recorders. The number of samples taken, and their frequencies, can all be set and read by standard CAMAC function commands.

The LeCroy Model 8501 allows the programming of a CAMAC crate full of transient recorders. However, the outputs can be further fanned out by modules such as the LeCroy 429A to provide a master clocking circuit for an entire transient-recorder-based data acquisition system.

November 1979

Instrumentation for the study of transient phenomena

LeCROY RESEARCH SYSTEMS OF CALIFORNIA • 1806 Embarcadero Rd. • Palo Alto, California 94303
TELEPHONE: (415) 328-3750 TWX: 910-373-1791

PRELIMINARY SPECIFICATIONS
CAMAC Model 8501
PROGRAMMABLE THREE-SPEED CLOCK GENERATOR

INPUT CHARACTERISTICS

Control Inputs: Three LEMO coaxial connectors. Provide control triggers for the transfer from f0 to f1 (Mode I and II), the transfer from f1 to f2 (Mode II), and the start of clock bursts (Mode IV) respectively.

OUTPUT CHARACTERISTICS

Stop Trigger Output: 6 each LEMO coaxial connectors. TTL levels.

Clock Outputs: 6 each LEMO coaxial connectors. TTL levels. Mode III operation provides 3 each normal clock outputs and 3 each complementary clock outputs.

GENERAL

Modes:

I. 3 Programmable Frequencies and 2 preset numbers of samples—6 outputs.

II. 3 Programmable Frequencies with external frequency-change triggers, where the number of samples taken at each frequency is recorded.

III. Interleaving Clock—Adjacent outputs alternate at rates up to 20 MHz. The frequency cannot be changed during sampling.

IV. Issues burst of clock pulses for each successive control input #2. Frequency burst length is determined by the preset counter for f2 (F(16)•A(0). A stop trigger output is issued at the end of each burst. Burst can be terminated early by front-panel button or by issuing a CAMAC F(25) command.

Stop Triggers:

Mode I: Stop trigger is issued after counter for clock frequency f3 has overflowed.
Mode II: Input #3 is fed through to the output. (Must be preceded by control #1 & #2 in sequence).
Mode III: No stop trigger is issued.
Mode IV: Stop trigger issued at end of burst.

READOUT CHARACTERISTICS

CAMAC Commands: Z or C or F(9): Reinitiates continuous sampling cycle (Mode III). Requires S2. Also clears LAM register.

X: An X=1 (command accepted) response is generated when a valid F and N are present.

CAMAC Function Codes: F(0): F(0)•A(0) reads the number of clock pulses at the second frequency (f2) in Mode II.
F(0)•A(1) reads the number of clock pulses at f3 in Mode II.
F(0)•A(2) reads the Lam register.
R1—stop trig LAM.
R2—f2 counter overflow.
R3—f3 counter overflow.

Note: Unit will return Q=1 for F(0) when the unit is in Mode II and the cycle has been completed.

F(8): Test LAM; requires N. Q response is generated if LAM is set.

F(10): F(10)•A(0): clears the LAM associated with an f2 count overflow in Mode II.

F(10)•A(1): clears the LAM associated with an f2 count overflow in Mode II.

F(10)•A(2): clears the LAM associated with an f3 count overflow in Mode II.

F(16): F(16)•A(0): writes the number of clock pulses at f2 in Mode I and the number of burst pulses in Mode IV.

F(16)•A(1): writes the number of clock pulses at f3 in Mode I.

F(16)•A(2): selects the frequency range, according to W1 & W2, as below:

W1=1, W2=0; 200 Hz—20 MHz (Hi Range).
W1=0, W2=1; 20 Hz—2.0 MHz (Lo Range).
f1, f2, and f3 must all be within the same range.

F(16)•A(3): sets frequencies f1, f2, f3 according to the data on lines W1-W12
W1-W4 determines f1.
W5-W8 determines f2 : 50% duty cycle
W9-W12 determines f3

Each 4-bit segment sets frequencies according to the following table:

W(x+3)	*W(x+2)*	*W(x+1)*	*W(x)*	*Hi Range*	*Lo Range*	*W(x+3)*	*W(x+2)*	*W(x+1)*	*W(x)*	*Hi Range*	*Lo Range*
0	0	0	0	200 Hz	20 Hz	1	0	0	0	100 KHz	10 KHz
0	0	0	1	500 Hz	50 Hz	1	0	0	1	200 KHz	20 KHz
0	0	1	0	1 KHz	100 Hz	1	0	1	0	500 KHz	50 KHz
0	0	1	1	2 KHz	200 Hz	1	0	1	1	1 MHz	100 KHz
0	1	0	0	5 KHz	500 Hz	1	1	0	0	2 MHz	200 KHz
0	1	0	1	10 KHz	1 KHz	1	1	0	1	5 MHz	500 KHz
0	1	1	0	20 KHz	2 KHz	1	1	1	0	10 MHz	1 MHz
0	1	1	1	50 KHz	5 KHz	1	1	1	1	20 MHz	2 MHz

F(24): Disable LAM

F(25): Resets sequences. In Mode I, loads counters, enables and starts clock 1; resets control inputs. In Mode II, clears counters, enables clock 1, resets control inputs. No action in Mode 3. In Mode 4, loads counters, disables clock, resets control inputs.

F(26): F(26)•A(0) Enables Mode 1
F(26)•A(1) Enables Mode 2
F(26)•A(2) Enables Mode 3
F(26)•A(3) Enables Mode 4
F(26)•A(4) Enables LAM

PACKAGING: In conformance with CAMAC standard for nuclear modules (USAEC Reports #TID-25875, IEEE standard #583, European ESONE report #EUR4100e). RF-shielded CAMAC #1 module.

8501

OPERATIONAL DESCRIPTION

General

The LeCroy Model 8501 is a programmable clock generator designed to output crystal-controlled TTL-level pulse trains in sequences preset by CAMAC commands. There are 19 frequencies available, which can be programmed within each of two ranges according to any of the following operating modes:

Mode I: In this mode, the unit outputs a pulse train from the 6 front panel clock connectors, sequentially switched between three preset frequencies. Upon initiation of a cycle, the 8501 outputs f_1, the first of the frequencies selected; upon receiving a rising pulse at the Input 1 front panel connector, the frequency immediately shifts to the second clock frequency f_2. After a preset number of pulses at f_2, the frequency switches to f_3, the third selected frequency. After a preset number of pulses at f_3, the unit issues a positive-going output from its 6 stop output connectors and issues a LAM. f_3 continues until the next sequence is initiated.

Mode II: The unit outputs a pulse train from its 6 front panel clock connectors, again sequentially switched between 3 preset frequencies. Here, as in Mode I, f_1 appears when the cycle is initiated. Upon receipt of a rising signal at the Input 1 front panel connector, the frequency shifts to f_2, but remains there until receipt of a rising signal on the Input 2 front panel connector, at which time the frequency shifts to f_3 and remains until the next sequence is initiated. A subsequent rising signal on the Input 3 front panel connector results in a rising signal on the 6 stop output front panel connectors. Two sixteen-bit counters keep a tally of the number of pulses at f_2 and at f_3 (before the Input 3 signal) respectively, and can be read via the CAMAC bus. A LAM is issued on stop out and/or if either counter overflows.

Mode III: In this mode the 8501 outputs a single presettable frequency (f1) from its 6 clock output connectors; however, the signals on each pair of connectors are phase shifted from each other by 180°, allowing interleaved samples to be taken by two transient recorders.

Mode IV: The 8501 outputs a burst of pulses at a single frequency (f_2) from each of its 6 clock output connectors. Length and frequency of the burst can be preset via the CAMAC bus. The unit also outputs a low level from it 6 stop outputs for the duration of each burst. The burst is initiated by a rising signal on the input 2 connector. The pulse train can be terminated early by pushing the initiate button or by issusing a CAMAC F(25).

Front Panel Signals

Inputs

General:

Impedance: 1.5K Ω

Trigger level: TTL or NIM (jumper option)

Absolute maximum rating: ±15 volts continuous.

Input 1: Low to high transition causes 8501 clock outputs to shift from f_1 to f_2 in modes 1 and 2. No effect in other modes.

Input 2: Low to high transition causes 8501 clock outputs to shift from f_2 to f_3 in mode 2; initiates pulse train burst in mode 4. No effect in other modes.

Input 3: Low to high transition causes low to high transition on 8501 stop outputs in Mode 2 (after inputs 1 and 2 have been received). No effect in other modes.

Outputs

Clock Outputs - The 8501 provides 6 clock outputs, each capable of driving a 50 ohm terminated line. All outputs are in phase, except in mode 3, where outputs 2, 4 and 6 are shifted 180° from outputs 1, 3 and 5, to allow double-rate sampling using pairs of transient recorders. All clock signals in all modes are 50% duty cycle, TTL level.

Stop Outputs - The stop outputs are provided by the 8501 primarily for the purpose of supplying stop trigger inputs to transient recorders using the 8501 clocks. The six outputs are all in phase, TTL level signals capable of driving 50 ohm terminated lines.

Initiate Push Button

1) In mode 1, pushing this button resets the frequency of the clock outputs to f_1, clears any LAM, resets the input and stop output flip-flops, and presets the f2 and f_3 counters, readying the unit for another cycle. If pushed in the middle of a sequence, it will terminate the sequence.

2) In mode 2, pushing this button resets the frequency of the clock outputs to f1, clears any LAM, resets the input and stop output flip-flop, and clears the f2 and f3 counters, readying the unit for another mode II sequence. If the button is pushed during a sequence, the sequence will terminate.

3) No effect in Mode 3.

4) In mode 4, pushing this button will terminate a burst and preset the burst counter, leaving the unit ready to start another output burst.

CAMAC Control: NOTE: Signal levels discussed are CAMAC levels, i.e., a 1 level is TTL low.

F(8) - Test LAM

F(9),Z,C - Any of these signals clears the unit and puts the 8501 in Mode III.

F(10) - Clear LAM

F(10)A(0) - Clear Stop Trigger LAM
F(10)A(1) - Clear f2 Counter Overflow LAM
F(10)A(2) - Clear f3 Counter Overflow LAM

F(16) - Sets f1, f2, f3, frequency range or number of counts in f2 and f3 according to the subaddress, as listed below:
F(16)A(0) - Set f2 Count

F(16) A(1) - Set f3 count. The count will be the same as the magnitude of the binary word on CAMAC lines W_1-W_{16} (W_{16} is MSB)

F(16) A(2) - Set frequency range. Range is set according to the W1 and W2 lines as shown below.

W1	W2	Range
1	0	High; 200HZ - 20MHz
0	1	Low; 20HZ - 2MHz

F(16) A(3) - Set f1, f2 and f3. Sets all three frequencies according to the state of the CAMAC W1-W12 lines. Lines W1-W4 determine f1, W5-W8 determine f2, and W9-W12 determine f3. The correspondence between frequencies and write line states is the same for each group of lines and is shown for the high range in the following chart. For low range frequencies, simply divide the frequencies in the chart by 10.

	W(n+3)	W(n+2)	W(n+1)	W(n)
200Hz	0	0	0	0
500Hz	0	0	0	1
1KHz	0	0	1	0
2KHz	0	0	1	1
5KHz	0	1	0	0
10KHz	0	1	0	1
20KHz	0	1	1	0
50KHz	0	1	1	1
100KHz	1	0	0	0
200KHz	1	0	0	1
500KHz	1	0	1	0
1MHz	1	0	1	1
2MHz	1	1	0	0
8MHz	1	1	0	1
10MHz	1	1	1	0
20MHz	1	1	1	1

F(24): - Disable LAM

F(25): - Has the same effect as the "initiate" push button, as described earlier.

F(0): - Reads the magnitude of the f2 and f3 counters (mode 2), or reads the LAM register (mode 2) depending on the subaddress.

F(0) A(0): Read f2 count. Will not return Q unless mode 2 is enabled and a sequence is complete (stop outputs high). Data is output on CAMAC lines R1-R16 (R16 is MSB).

F(0) A(1): Read f3 count. Will not return Q unless mode 2 is enabled and a sequence is complete (stop outputs high). Data is output on CAMAC lines R1-R16 (R16 is MSB).

F(0) A(2): Read LAM Register. Outputs content of LAM register on the CAMAC R1-R3 lines. Will not return Q if mode 3 is enabled. See table below for correspondence between read lines and register states.

R1=1 Stop output low to high transition (mode 1,2, and 4)

R2=1 f2 count overflow (mode 2 only)

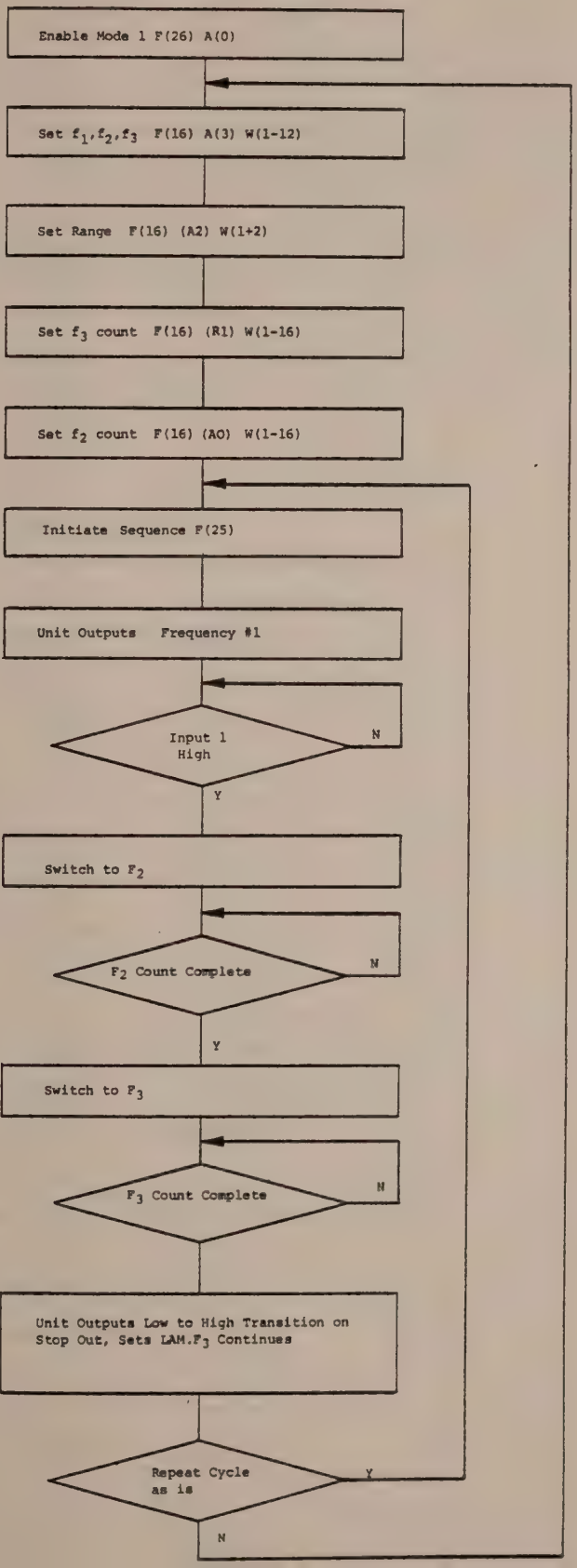
R3=1 f3 count overflow (mode 2 only)

Functional Description

The 8501 clock outputs are derived by digital counters from an 80MHz crystal oscillator. Frequencies are selected by 3 multiplexer, each controlled by a flip-flop register which is loaded via the CAMAC bus. Sequencing of the frequencies thus selected is governed by control logic according to the mode set from the CAMAC bus. Two sixteen-bit counters determine frequency shift points in modes 1 and 4, and count clock pulses in Mode 2. The counters can be reset according to two 16-bit registers which are loaded from the CAMAC bus. The contents of the counters can also be read onto the bus (mode 2 only).

Control Sequences and Sequence Flowchart

Mode 1



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DATE

DRAWING NUMBER

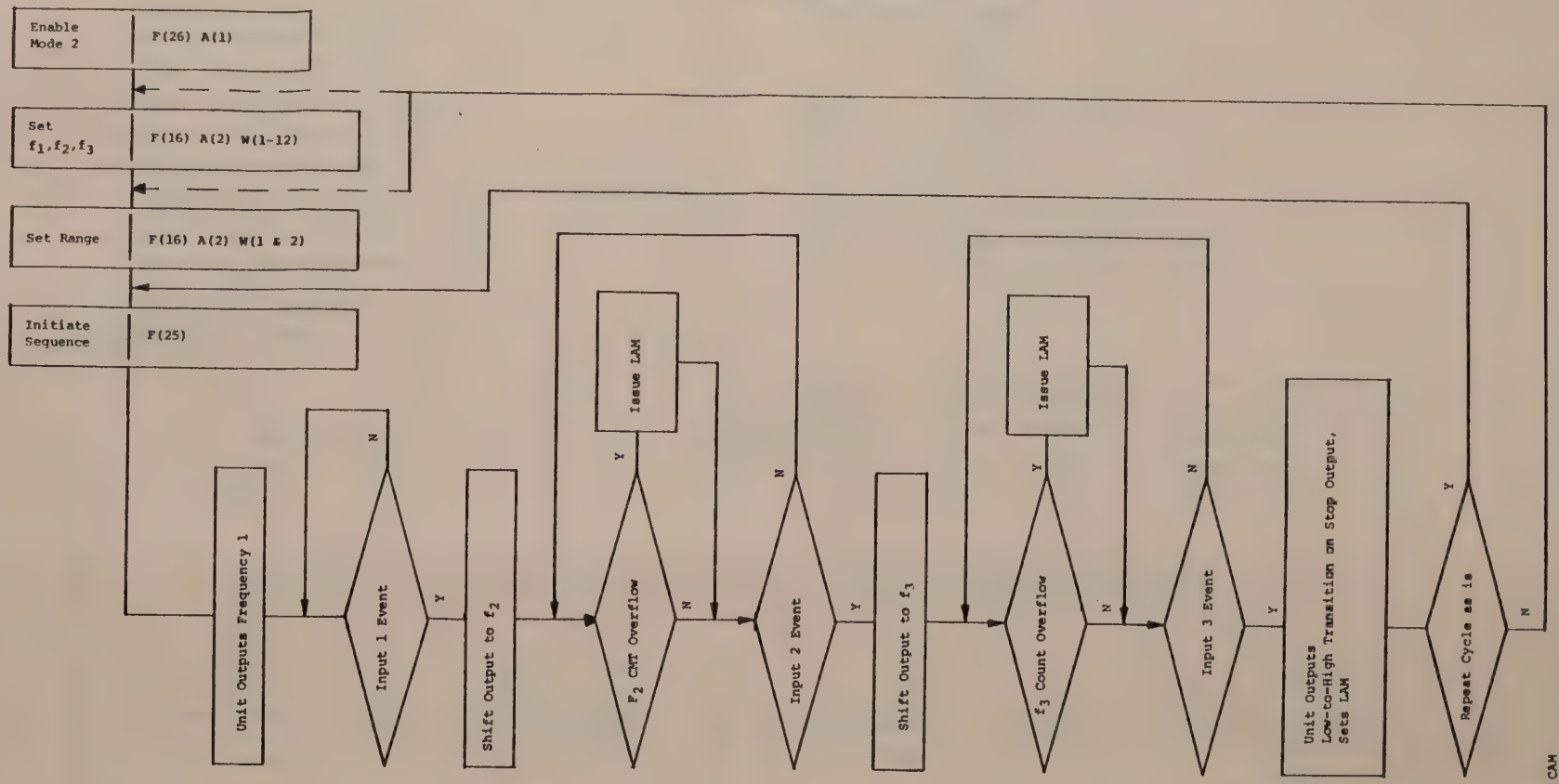
SHEET OF

ECO NO.

DATE

MODE II

Control Sequences and Sequence Flowchart



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Control Sequences and Sequence Flowchart

Mode III

Enable Mode 3	F(26) A(2) or F(9) or Z or C
Set f_1	F(16) A(3) W(1-4)
Set Range	F(16) W(1 and 2)

Frequency may be altered without resetting Mode.

Mode IV

Enable Mode 4	F(26) A(3)
Set f(2)	F(16) A(3) W(5-8)
Set f_2 count (burst length)	F(16) A(0) W(1-16)
Initiate sequence (Clears LAM stops Clock)	F(25)

Clear LAM F(25)orF(10)

LAM Issued

Optional

Input 2 Event

Y

N

Unit Outputs Frequency 2; Stop Outputs Go from High to Low

Count Complete

Y

N

Clock Stops. Low to High Transition on Stop Outputs

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ECO NO.	DATE	PRIORITY	DESCRIPTION
1000	1/24/79		MATERIALS LIST CHANGE, ADDED PC BOARD SIZE AND ADDED NEW PRE-ASSEMBLY NUMBERS.
1001	2/1/79		STANDARDIZATION OF HARDWARE
1002	8/27/79		PC ARTWORK CHANGE OF TRIGGER THREASHOLD.
1003	10/25/79		PARTS LIST, ASSEMBLY AND SCHEMATIC TO REFLECT NEW PARTS.

Remarks: On Priorities
1-Recall, field retrofit
2-Rework shippable units
3-Rework units in fabrication, assembly or test
4-Improvements for future MO's

LeCroy RESEARCH SYSTEMS

DRAWN

CHECKED

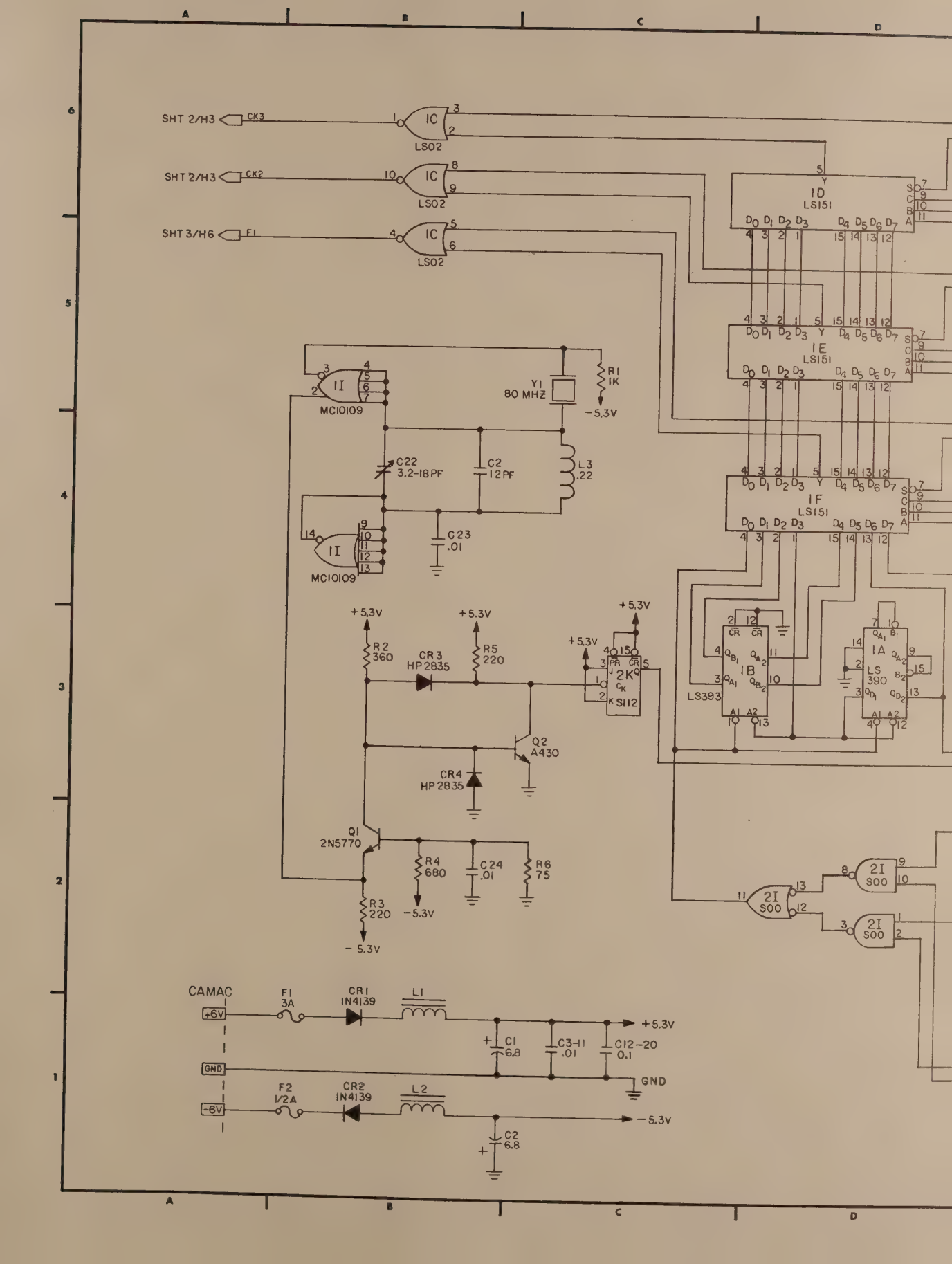
DATE

ENGINEERING CHANGE ORDERS

MODEL: 8501

DRAWING NUMBER:

OGILVIE PRESS BUFFALO, NY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CK3
IC
LS02
SHT 2/H3
CK2
IC
LS02
SHT 3/H6
F1
IC
LS02
ID
LS151
IE
LS151
IF
LS151
II
MC10109
II
MC10109
Y1
80 MHz
R1
1K
-5.3V
C22
3.2-18PF
C2
12PF
L3
.22
C23
.01
+5.3V
R2
360
CR3
HP2835
R5
220
2K
SI12
Q2
A430
CR4
HP2835
Q1
2N5770
R4
680
C24
.01
R6
75
R3
220
-5.3V
LS393
1B
1A
LS
390
2I
S00
2I
S00
2I
S00
CAMAC
+6V
GND
-6V
F1
3A
CR1
IN4139
L1
F2
1/2A
CR2
IN4139
L2
C1
6.8
C3-11
.01
C12-20
0.1
C2
6.8
+5.3V
GND
-5.3V

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE CC, 1/4W, ±5%
2. ALL RESISTANCE VALUES ARE IN OHMS.
3. ALL CAPACITANCE VALUES ARE IN MICROFARADS.

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LeCroy RESEARCH SYSTEMS

DRAWN MSF	SCHEMATIC, 8501 CLOCK MODULE
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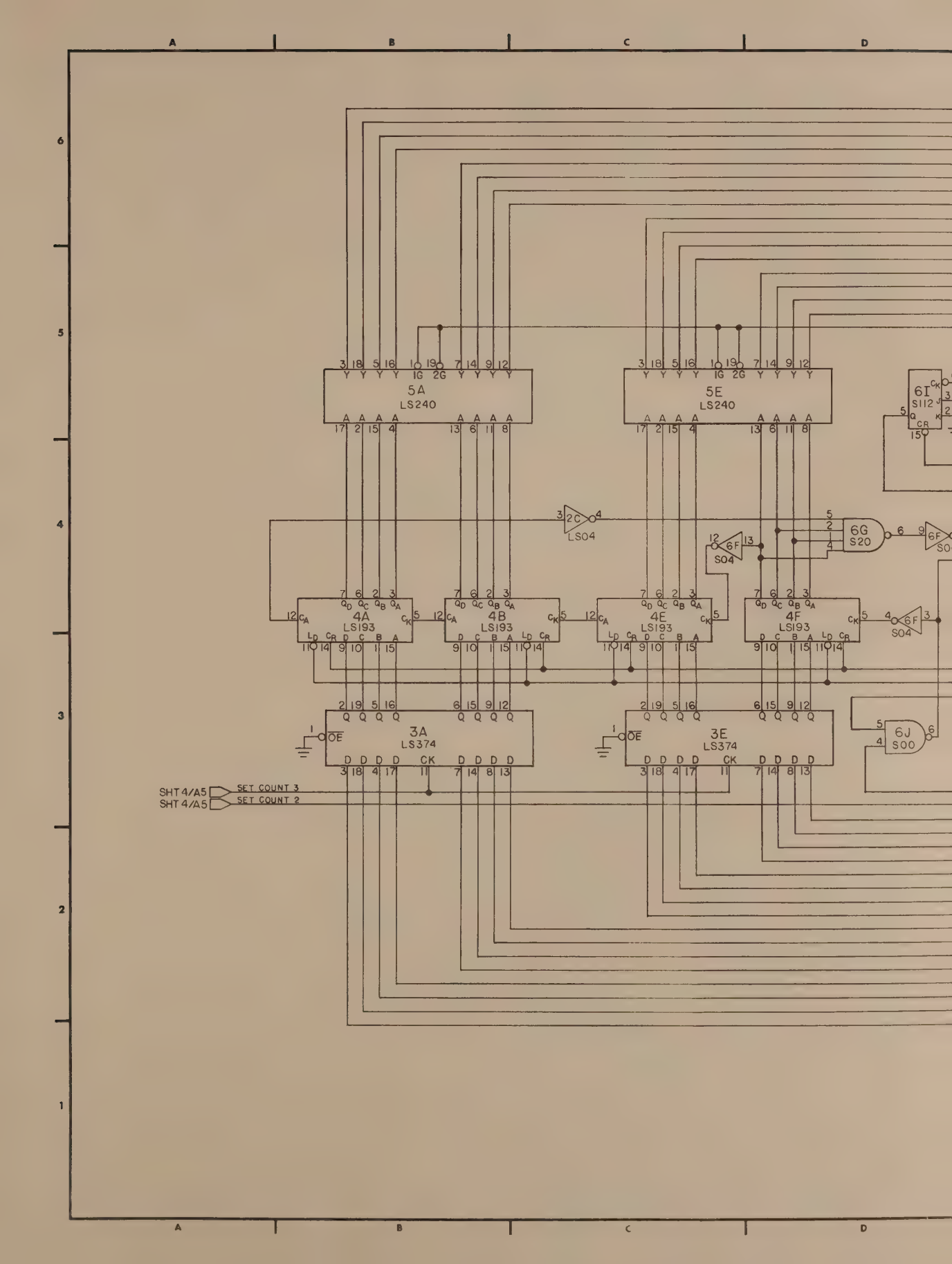
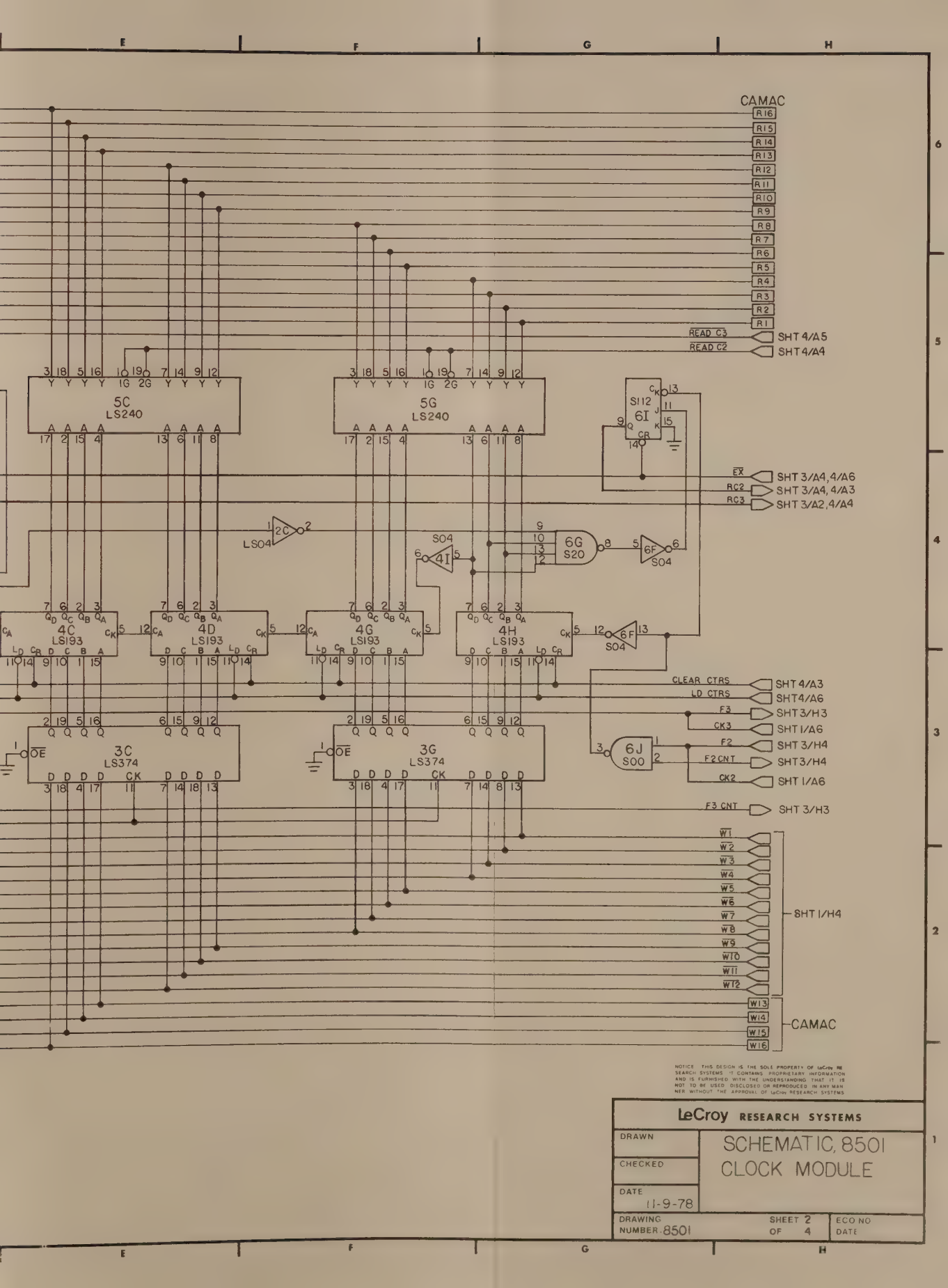
DATE 11-9-78	
DRAWING NUMBER: 8501	SHEET 1 OF 4
ECO NO. 1003 DATE 3/14/79	


5A
LS240
5E
LS240
6I
S112
4A
LS193
4B
LS193
4E
LS193
4F
LS193
3A
LS374
3E
LS374
6G
S20
6J
S00
LS04
SHT 4/A5
SET COUNT 3
SHT 4/A5
SET COUNT 2



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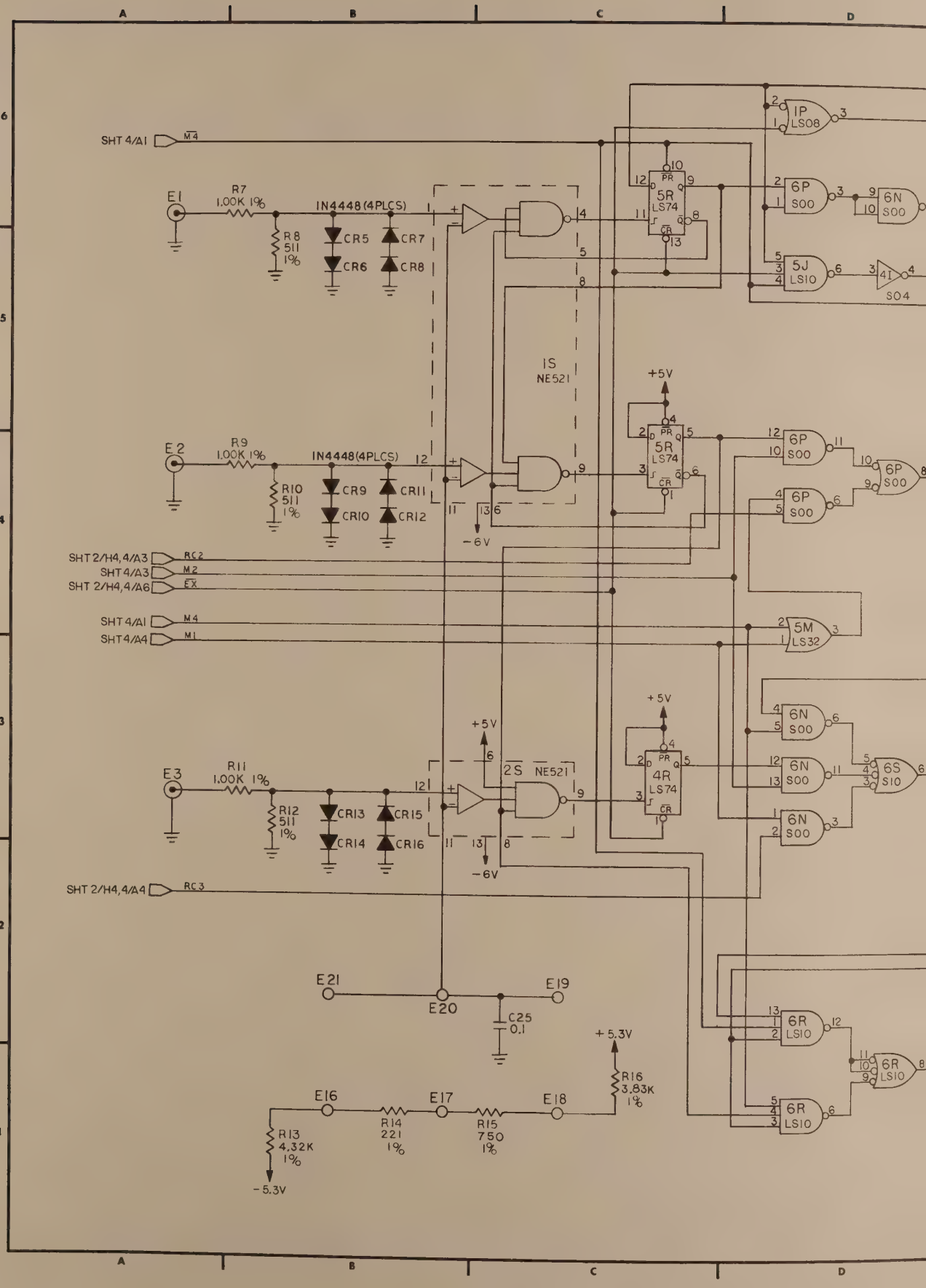
DATE 11-9-78	
DRAWING NUMBER 8501	SHEET 2 OF 4
ECO NO	DATE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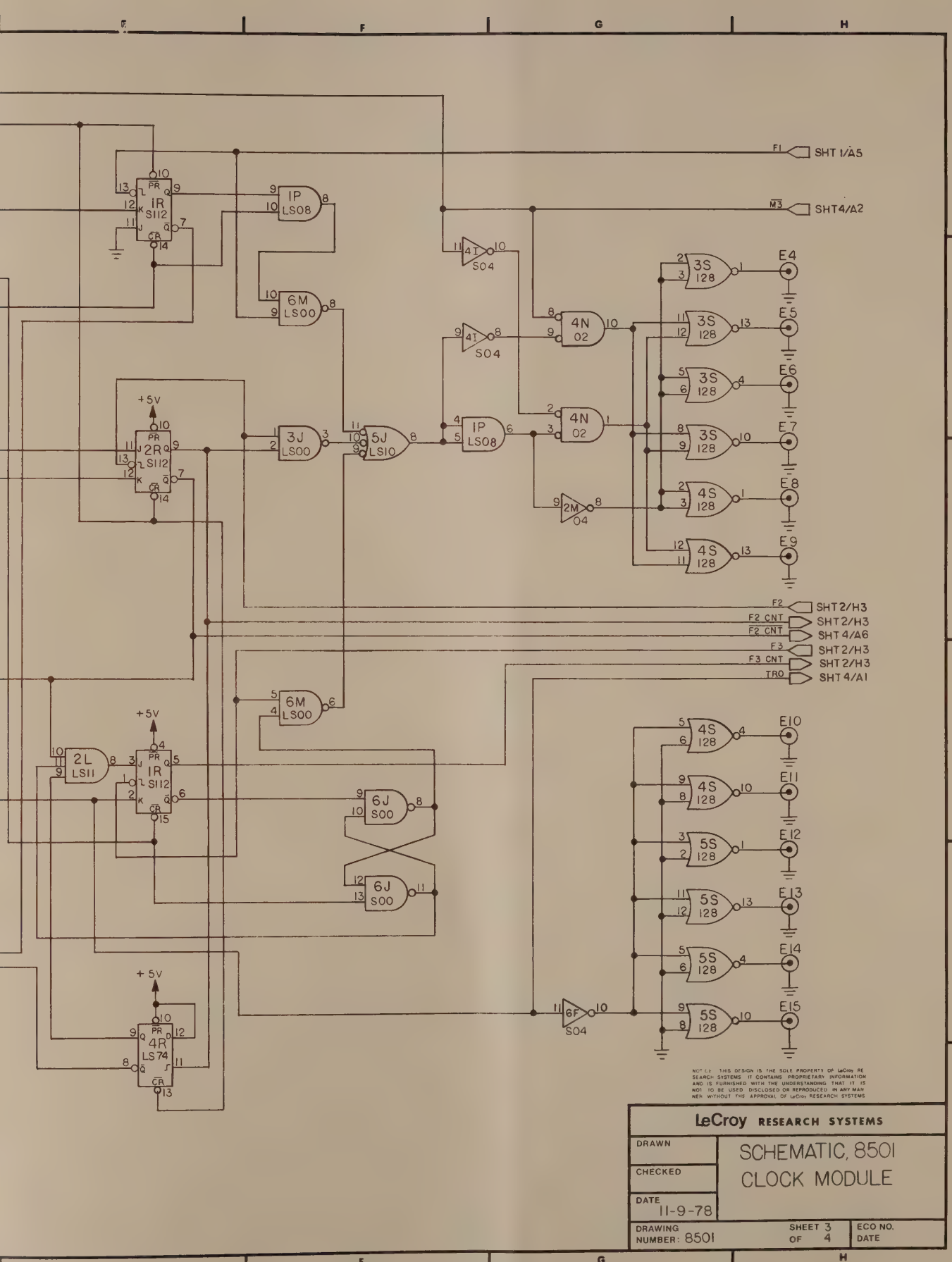
M4
E1
R7
1.00K 1%
IN4448(4PLCS)
R8
511
1%
CR5
CR6
CR7
CR8
1S
NE521
5R
LS74
1P
LS08
6P
S00
6N
S00
5J
LS10
4I
S04
+5V
E2
R9
1.00K 1%
R10
511
1%
CR9
CR10
CR11
CR12
-6V
SHT 2/H4,4/A3
RC2
SHT 4/A3
M2
SHT 2/H4,4/A6
EX
SHT 4/A1
M4
SHT 4/A4
M1
5M
LS32
E3
R11
1.00K 1%
R12
511
1%
CR13
CR14
CR15
CR16
2S
NE521
4R
LS74
6S
S10
SHT 2/H4,4/A4
RC3
E21
E20
E19
C25
0.1
+5.3V
R16
3.83K
1%
E16
E17
E18
R13
4.32K
1%
R14
221
1%
R15
750
1%
-5.3V
6R
LS10



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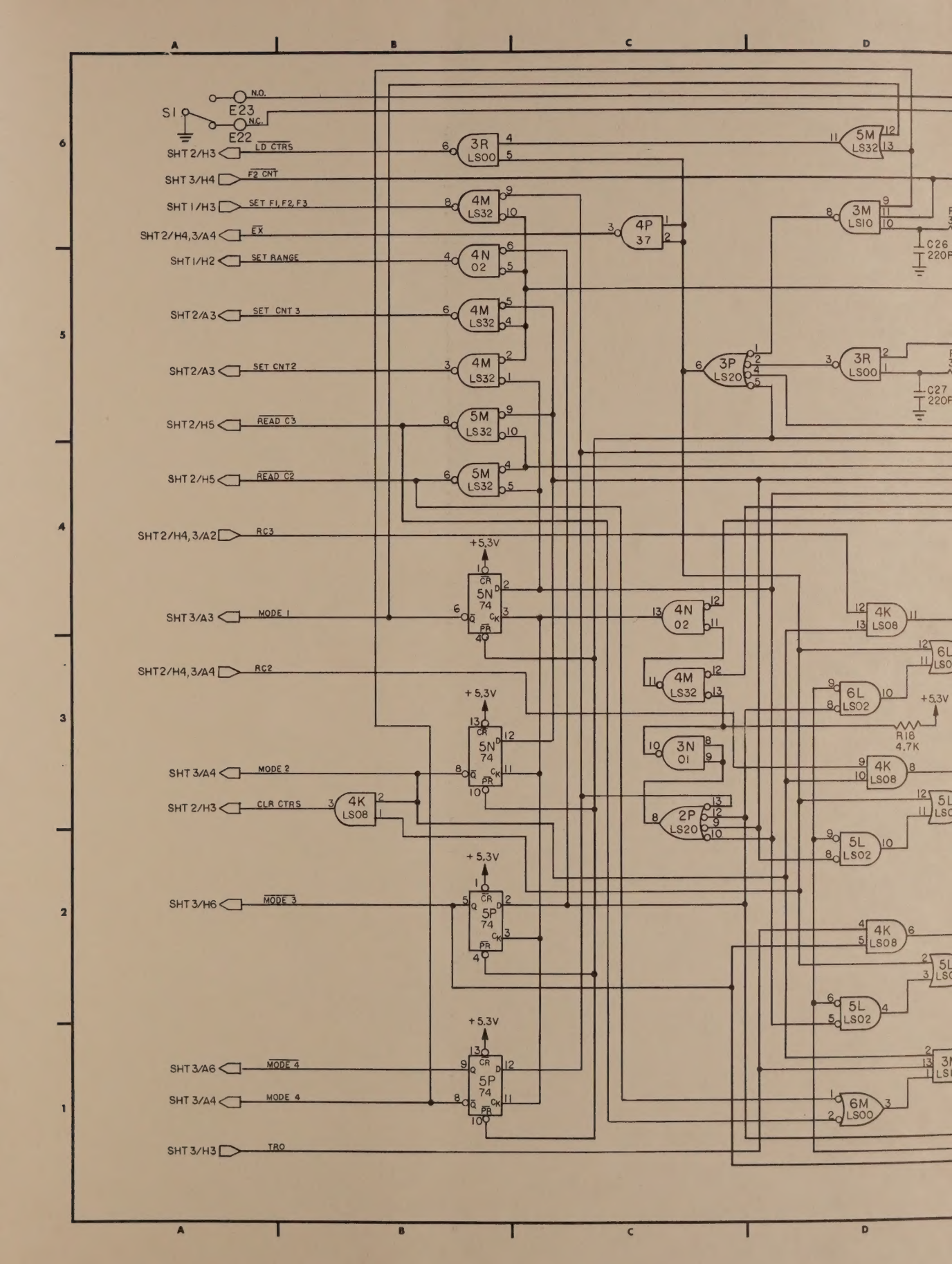
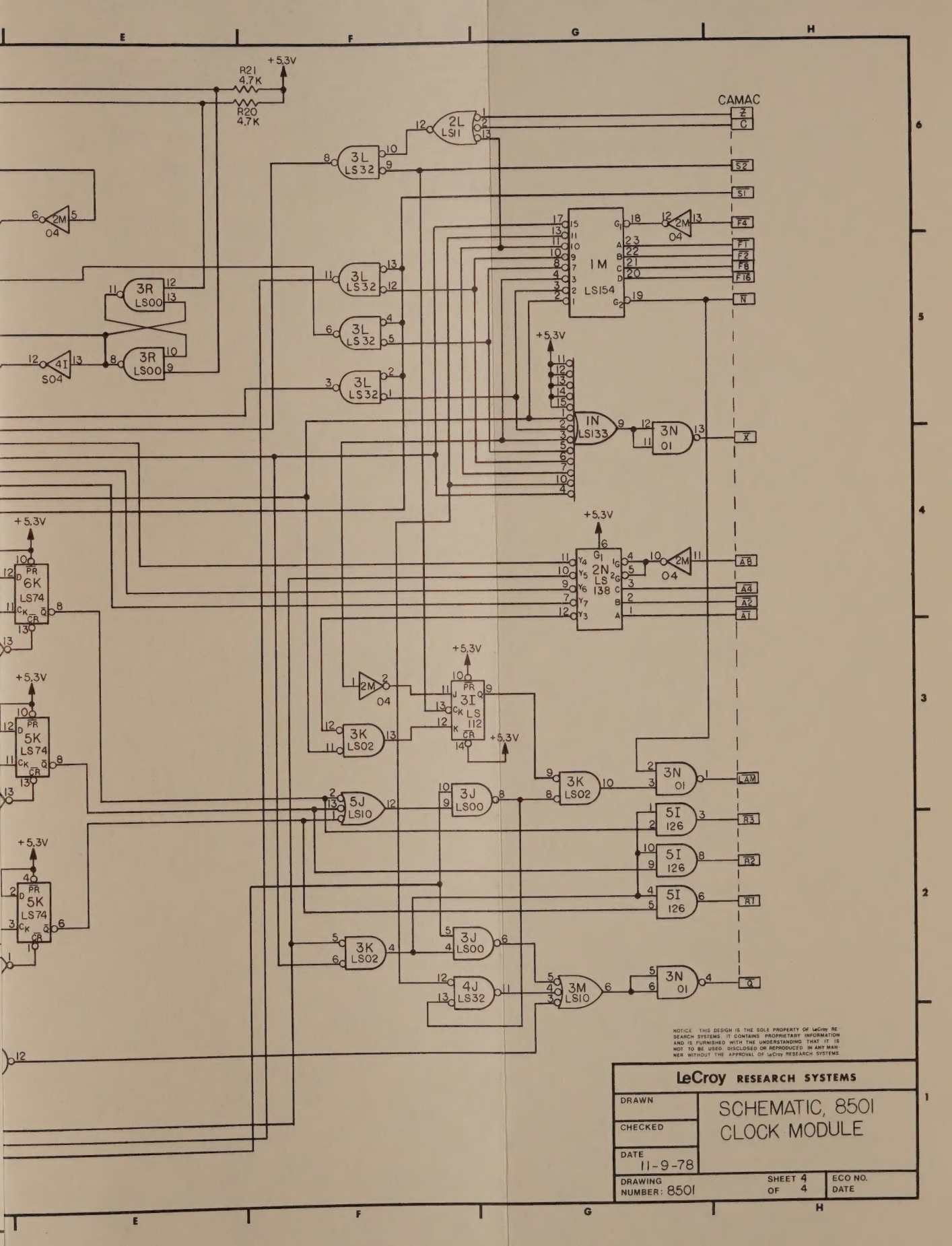
CHECKED	
DATE 11-9-78	
DRAWING NUMBER: 8501	SHEET 3 OF 4
ECO NO. DATE	


A
B
C
D
6
5
4
3
2
1
S1
N.O.
E23
N.C.
E22
SHT 2/H3
LD CTRS
SHT 3/H4
F2 CNT
SHT 1/H3
SET F1, F2, F3
SHT 2/H4, 3/A4
EX
SHT 1/H2
SET RANGE
SHT 2/A3
SET CNT 3
SHT 2/A3
SET CNT2
SHT 2/H5
READ C3
SHT 2/H5
READ C2
SHT 2/H4, 3/A2
RC3
SHT 3/A3
MODE 1
SHT 2/H4, 3/A4
RC2
SHT 3/A4
MODE 2
SHT 2/H3
CLR CTRS
SHT 3/H6
MODE 3
SHT 3/A6
MODE 4
SHT 3/A4
MODE 4
SHT 3/H3
TRO
3R LS00
4M LS32
4P 37
4N 02
5M LS32
5N 74
3N 01
2P LS20
3P LS20
4K LS08
6L LS02
5L LS02
6M LS00
3M LS10
+5.3V
R18 4.7K
C26 220P
C27 220P


+5.3V
R21 4.7K
R20 4.7K
CAMAC
Z
C
S2
S1
F4
F1
F2
F8
F16
N
X
A8
A4
A2
A1
LAM
R3
R2
R1
Q
2L LS11
3L LS32
1M LS154
04
3R LS00
S04
1N LS133
3N 01
2N LS 138
6K LS74
5K LS74
3I LS 112
3K LS02
5I 126
5J LS10
3J LS00
4J LS32
3M LS10
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DRAWN
CHECKED
DATE 11-9-78
SCHEMATIC, 8501 CLOCK MODULE
DRAWING NUMBER: 8501
SHEET 4 OF 4
ECO NO.
DATE

Switch Settings for 8258 Digitizer (all 4 modules are same)

1. O pen
2. C losed
3. C
4. O
5. C
6. O
7. O
8. O

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